Schlepping Toward Sustainability:

One Couple's Quest to Shrink Its Environmental Footprint

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Lawrence Berkeley National Laboratory
Environmental Energy Technologies Division Seminar

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Q & A

- *To* the Audience
- Who coined the term “Gas-Guzzling Dinosaur” referring to Detroit’s oversized vehicles, and when?
- Who said “Let this be our national goal: At the end of this decade, in the year ____, the United States will not be dependent on any other country for the energy we need to provide our jobs, to heat our homes, and to keep our transportation moving.” and when?

Outline

- Global thinking
- Local acting
  - Example: a couple from the People's Republic of Berkeley
  - You

Definitions

- **Schlepping**: (Yiddish slang) pull along heavily, like a heavy load against a resistance; "Can you schlep this bag of potatoes upstairs?"
- **Sustainability**: “Meeting the needs of the present without compromising the ability of future generations to meet their own needs”
- **Environmental (or Ecological) Footprint**: “an estimate of the amount of biologically productive land and sea area needed to regenerate (if possible) the resources a human population consumes and to absorb and render harmless the corresponding waste, given prevailing technology and current understanding.”
- **Efficiency**: ratio of output to input
- **Conservation**: using less

When efficiency and conservation aren't the same

8000 sf, 4 car garage, remote, greenfield site but Energy Star and LEED:
http://www.swinter.com/WinterGREEN/WGJanuary08.pdf

Beyond global…

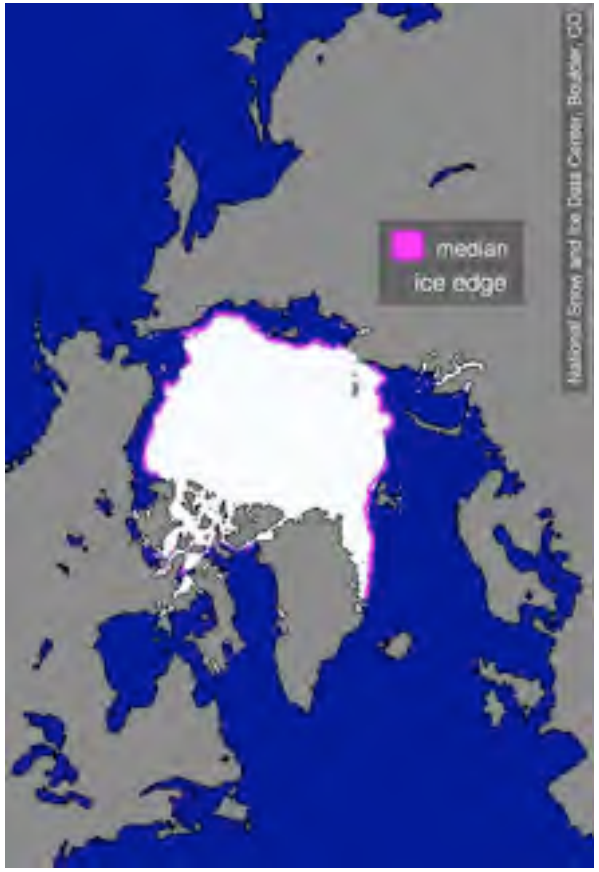
What do we know about climate?

- "**Unequivocal**" that the earth's climate is warming
- **More than 90% certainty** that human emissions of CO_2 and other greenhouse gases are the cause

(Findings from IPCC 2007 WGI, AR4)

Slide courtesy Jon Koomey

Going, going, gone?



The difference between median minimum arctic ice coverage and the extent on Sept. 16, 2007 is equal to the area of Alaska and Texas combined (2.61 M sq. km or 1 M sq. miles). http://nsidc.org/news/press/2007_seaiceminimum/20070810_index.html

Regional climate change good news

- A one-meter rise in sea level would return the size of San Francisco Bay to its 1850 glory

Bay Conservation and Development Commission

Regional climate change bad news

- That same one-meter rise in sea level would flood $100 Billion in real estate and infrastructure

Bay Conservation and Development Commission

What can we do?

Slide courtesy Jon Koomey

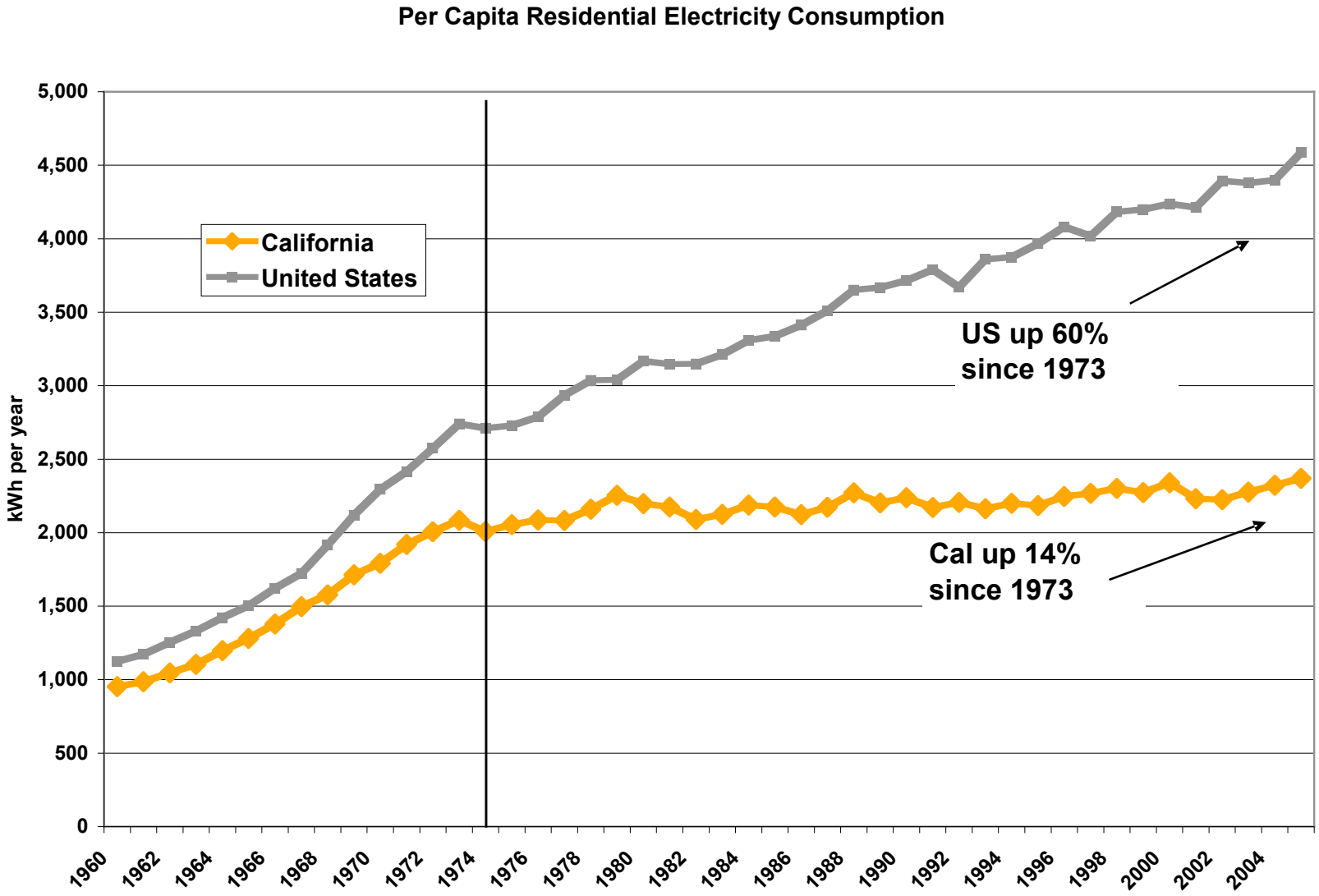
Few will get away…

Our options

- Adapt–modify human systems to make them more flexible and resilient
- Suffer–accept what comes (but what comes is likely to be costly in lives, ecosystem damage, and economic disruption)
- Mitigate–reduce emissions

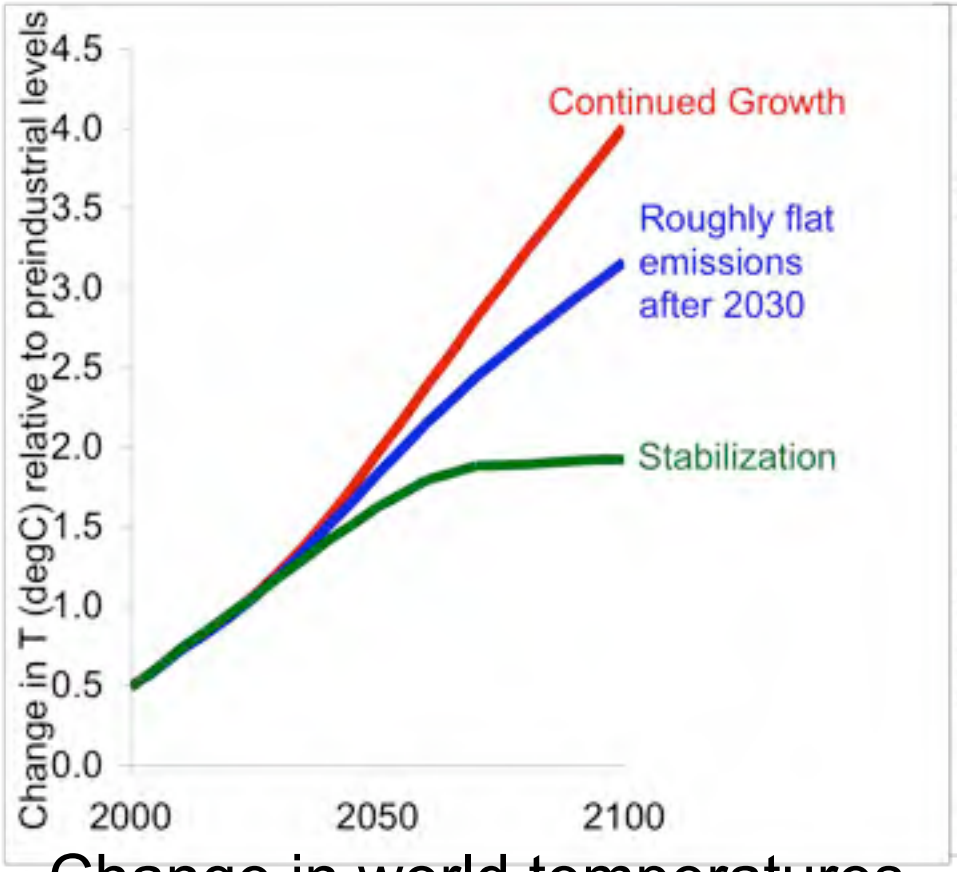
Slide courtesy Jon Koomey

Laurels(?)

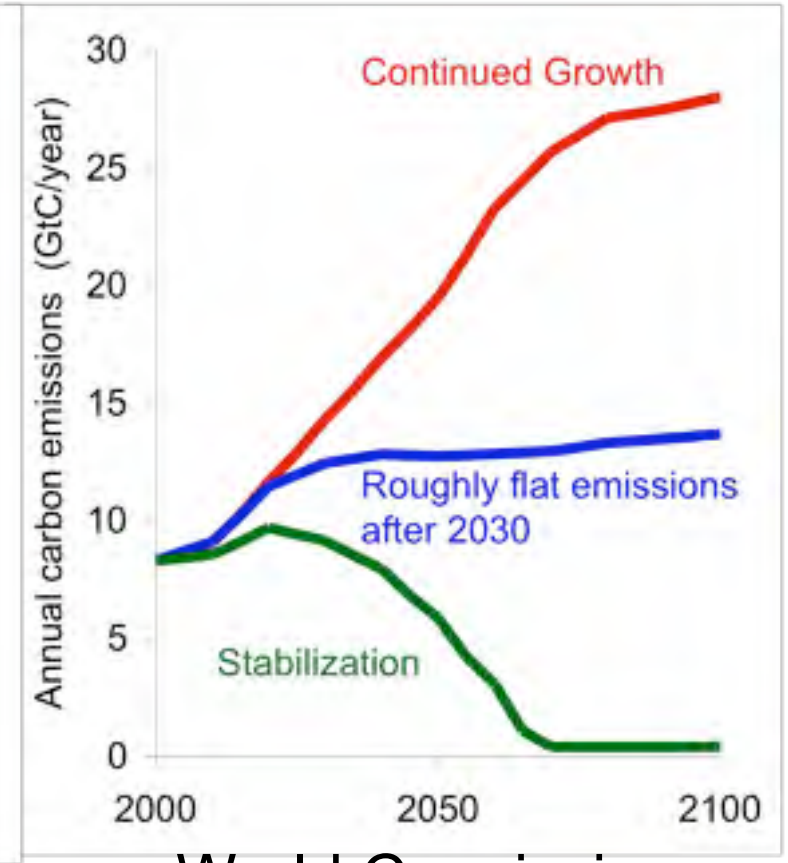


California Population: 21M in 1970, 28M in 1990, 37M in 2005

Halting growth in world carbon emissions is not enough



Change in world temperatures



World C emissions

Continued growth and flat emissions scenario are taken from the IIASA GGI database (A2r and B2, respectively). Stabilization case is adapted from the B2 480 ppm scenario. http://www.iiasa.ac.at/web-apps/ggi/GgiDb/

Slide courtesy Jon Koomey

Those Berkeley Wackos (part one)

- “How Berkeley Can You Be?” parade

September 28, 2008:
http://www.howberkeleycanyoube.com/parade.shtml

Those Berkeley Wackos (part 2)

- Tree sitting to save the oaks
- City council vs. US Marine Corps
- Other: “Berkeley: A City of Firsts” (Berkeley Historical Society, 1931 Center St., through September 27)

Berkeley City Slogan(?)

Don Asmussen, 2008 SF Chronicle

Those Berkeley Wackos (part 3):

Berkeley Climate Action Plan

- Homes and business to produce as much energy as they use by 2050
- Residents and workers rely on public transit, walking and biking
- Cars would run on alternative fuels and electricity
- No waste would be sent to landfills
- most of the food eaten in Berkeley would be produced within a few hundred miles

American Gothic

by Grant Wood, 1930

Berkeley Gothic

by Don “The Bad Reporter” Asmussen, 2008

Liz and Steve

(Those Berkeley Wackos, Part 4)

by John Lee, 2008

"A Deeper Shade of Green: Counting Volts in Berkeley", Sam Whiting, SF Chronicle
http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/06/22/CM3L10HMNE.DTL

1440 Ordway: Measures to Date

- Wall and ceiling insulation
- Solar domestic water heating system
- Fluorescent lighting
- Energy Star appliances
- Standby loss reduction (80W residual inc. lighting)
- Photovoltaic (solar electric) systems
- Electric vehicle
- Window and door retrofits
- Low water use fixtures, turf removal, drip irrigation

Solar Water Heater, Cool Roof

Light bulb jokes

- How many
  - Jugglers
  - Marxists
  - Free market capitalists
  - Surrealists

    does it take to change a lightbulb?

A bit more serious

Lightbulbs are a good start, but

Bizarro, June 2007

A Solar “Barn Raising”:
Ordway Solar Power Plant Unit One

Off with the old roof…

…out with the old rafters…

…in with the new.

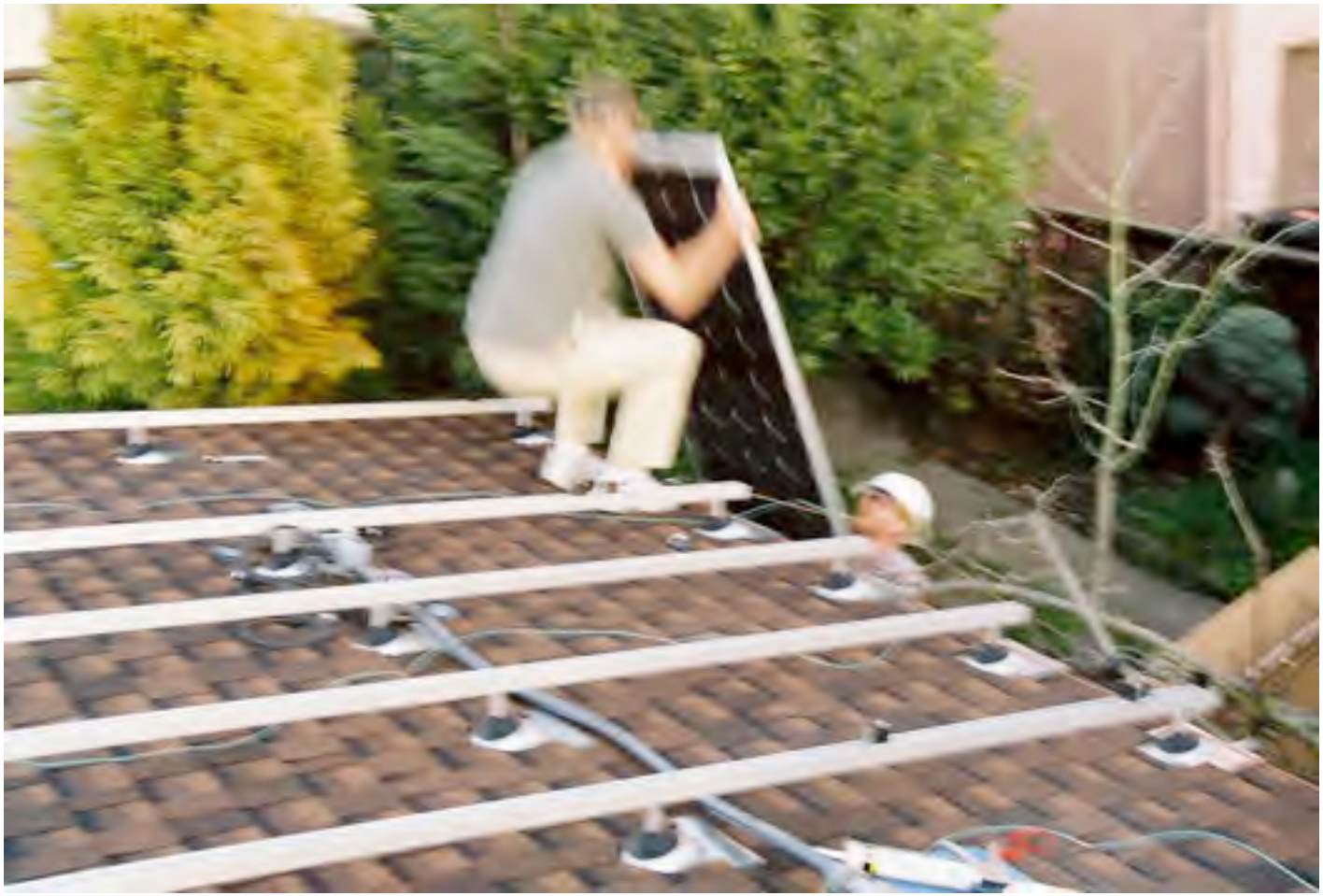
New roof deck (sustainable lumber)

…roofing, then posts and racks for the array of modules…

…almost there, cookie break…

…aligning the first module…

….the modules go on with a blur…



Sit of approval from Inspecteur Catseau.

Solar Power Plant Unit One, Skylights, Solar Clothes Dryer, Neighbor's PV

OSPP 1 at 10,000 kWh
Grid-tie only; 2.2 kW AC rating

Electric Car added in 2004

- Greatly reduced our gasoline usage (~80%)
- Wiped out surplus PV electricity (3 mi/kWh)

Dontcrush.com became PlugInAmerica

Ordway Solar Power Plant
Unit 2

Like Unit 1, grid-tie only; 2.5 kW AC rating

Ordway Solar Power Plant
Unit 2

Units 1 and 2, Neighbor's PV and Sunroom, Berkeley EcoHouse

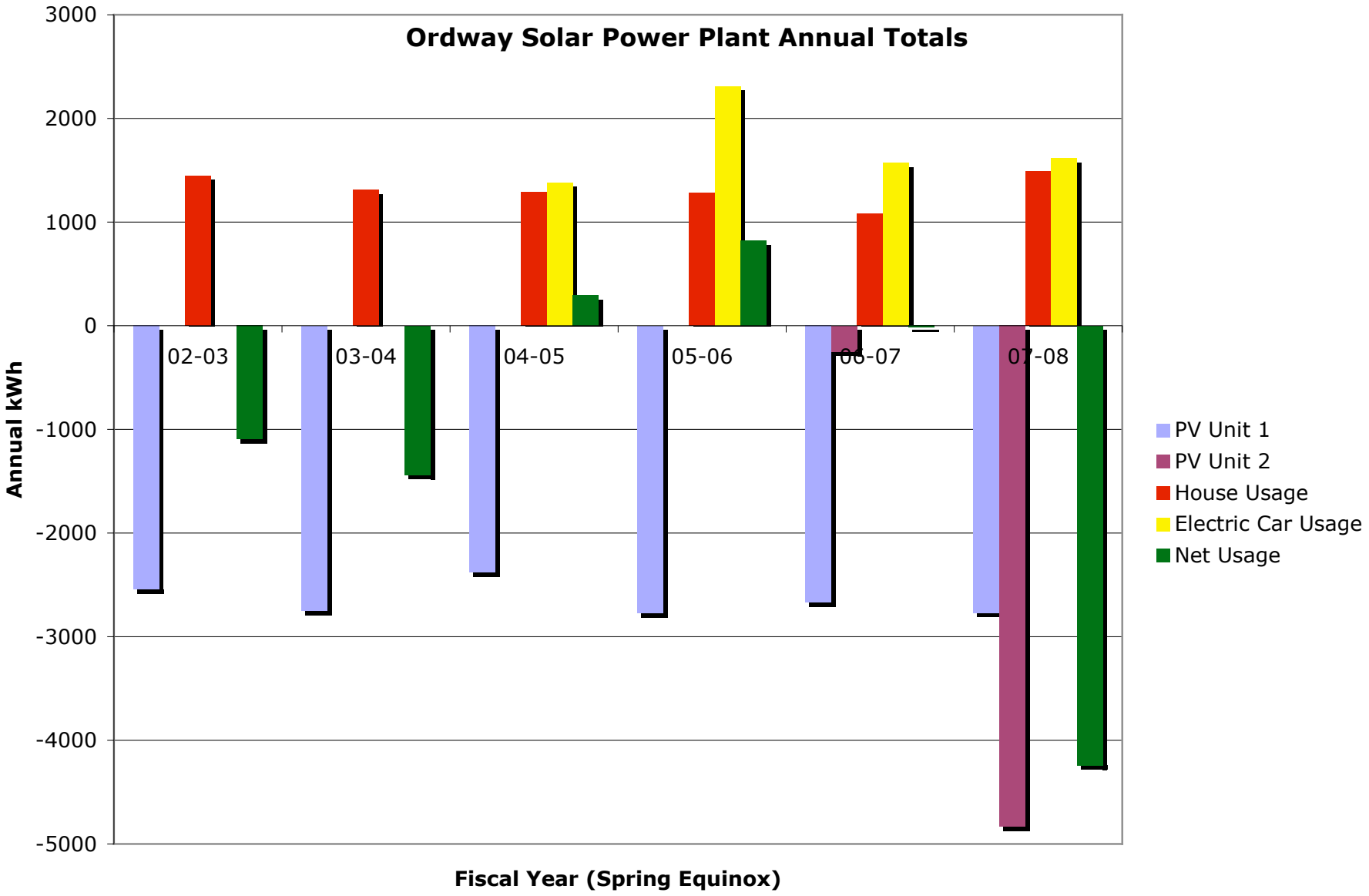
“Westbrae Solar Power Collective”

Keeping Up with the Joneses, Berkeley Style

Solar PV systems to date: 28

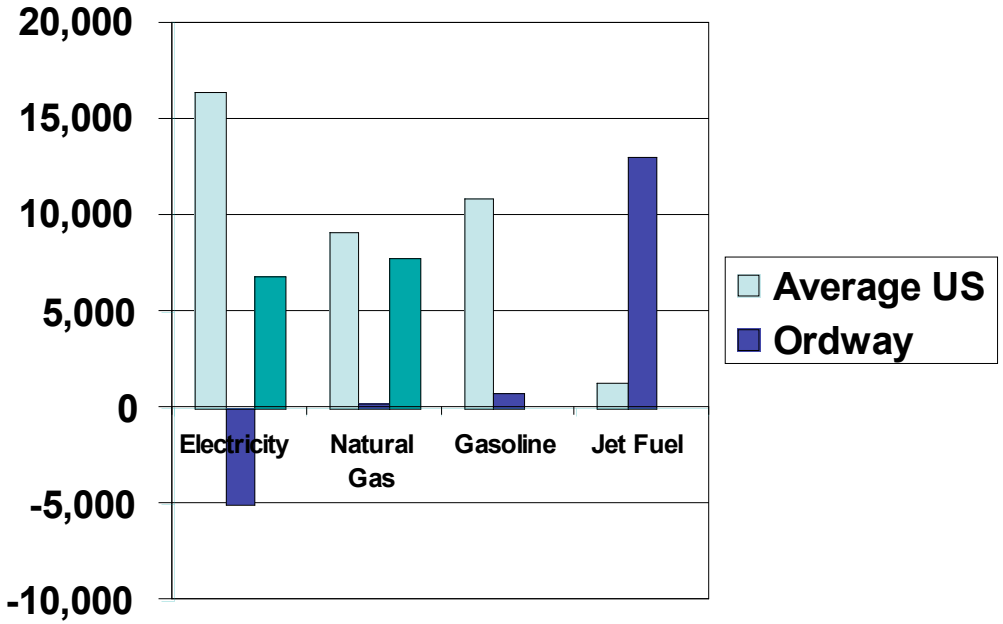
Solar DHW systems to date: 8

Alternative fuel vehicles to date: many
(biodiesel, SVO, electric, CNG)


Ordway Solar Power Plant Annual Totals
3000
2000
1000
0
-1000
-2000
-3000
-4000
-5000
Annual kWh
02-03
03-04
04-05
05-06
06-07
07-08
Fiscal Year (Spring Equinox)
PV Unit 1
PV Unit 2
House Usage
Electric Car Usage
Net Usage

Carbon Comparison

- Typical US household annual carbon footprint:
  - 38,000 pounds CO2e:
    - electricity 16,000 (11,000 kWh)
    - natural gas 9100 (760 therms)
    - gasoline 9500 (560 gallons)
    - jet fuel 1300 (980 miles)
- OSPP carbon footprint:
  - 9,000 pounds
    - electricity -5100 (-4200 kWh)
    - natural gas 250 (21 therms)
    - gasoline 820 (42 gallons)
    - jet fuel 13,000 (ca. 10,000 miles)
- SF Area PG&E:
    - Electricity 5600 kWh
    - Gas 640 therms



  - Bonneville Environmental Foundation

    http://www.greentagsusa.org/greentags/calculator/

1440 Ordway: what next?

(continuous improvement)

- Additional insulation (floor, etc.)
- Cistern for rain water use
- Waste water heat recovery
- On-demand hot water pump
- Fireplace removal
- More vampire/standby eradication
- More window retrofits
- Hydronic ground-source heat pump space and water heating system
- Certifications:
  - Wildlife Habitat (NWF) http://www.nwf.org/backyard/
  - Energy Star Home (EPA)

Power-pipe drainwater heat recovery

All-electric home?

If done well, can be very green

Berkeley Climate Action Plan

Ordway Solar Power Plant Report Card

- Homes and business to produce as much energy as they use by 2050
  - DONE 48 years ahead of schedule
- Residents and workers rely on public transit, walking and biking
  - DONE 51 years ahead of schedule
- Cars would run on alternative fuels and electricity
  - DONE 46 years ahead of schedule
- No waste would be sent to landfills
  - Still room for improvement at typical 10 oz/week
- most of the food eaten in Berkeley would be produced within a few hundred miles
  - Probably not; more data needed

What you can do

- Make a commitment
- Set goals
- Baseline your impact
- Plan steps of progress
- Implement plan
- Track progress
- Iterate

You can't manage what you don't measure

Read your electric, gas, and water meters and track usage

Track your fuel usage and air miles

Plug loads:

P3 International Kill-a-Watt Electricity Usage Monitor. $20 at Amazon.com. Measures watts, kilowatt-hours (over time), and other stuff. Just plug your device into it and plug it into the wall, and you're ready to go.

Slide courtesy Jon Koomey

Footprint Calculators and Offsets

- Wikipedia—links to eco, carbon, water:
  - http://en.wikipedia.org/wiki/Ecological_footprint#Calculators
- Earthday Footprint/Redefining Progress
  - http://www.myfootprint.org/
- Nature Conservancy
  - http://www.nature.org/initiatives/climatechange/calculator/
- Bonneville Environmental Foundation
  - http://www.greentagsusa.org/greentags/calculator/
- Terrapass
  - http://www.terrapass.com/
- The Climate Trust
  - http://www.climatetrust.org/programs_carboncounter.php
- Others…

Show and tell—some ideas

- “Don’t leave home without them”
  - Nylon, not paper or plastic
  - Bandana vs. paper towels, napkins
  - Travel mug, water bottle vs. disposables
- Low and no-cost home energy savers
  - Compact fluorescent lamps
  - Showerheads
  - Clothesline
  - REAL duct tape for sealing ducts
  - Switches

Solar Clothes Dryers

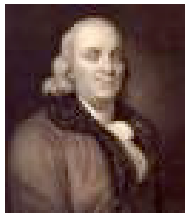
- 1 GW at California peak for Residential Clothes Dryers
  - Ideal time for drying
- Non-energy benefits (e.g.)
  - Clothes smell better, last longer
  - Kills germs
  - Fewer fires
- Need to change restrictions

http://right2dry.org/

http://www.laundrylist.org/

(National Hanging Out Day, etc.)

Solar Clothes Dryers



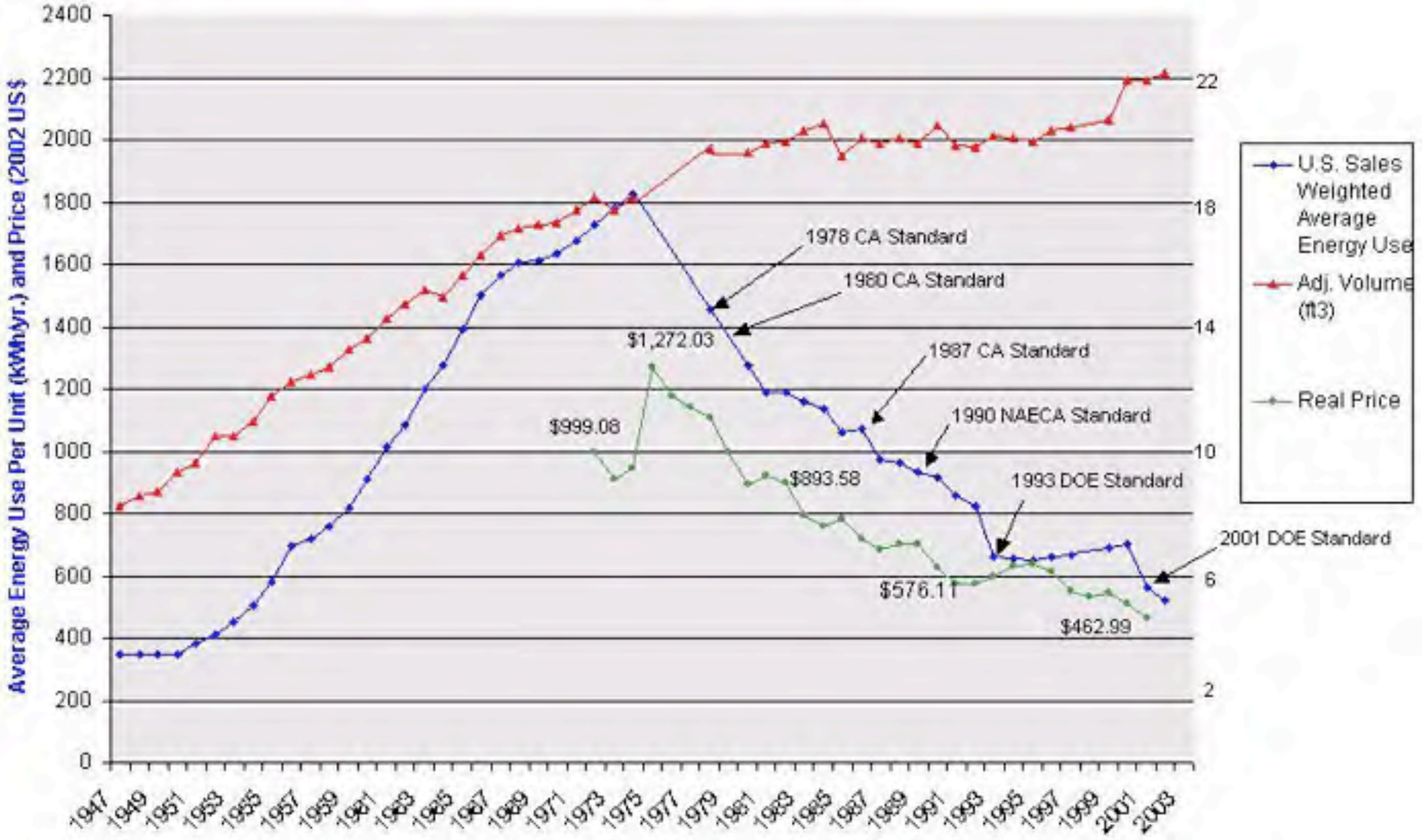
"We must all hang together, or most assuredly we will all hang separately."

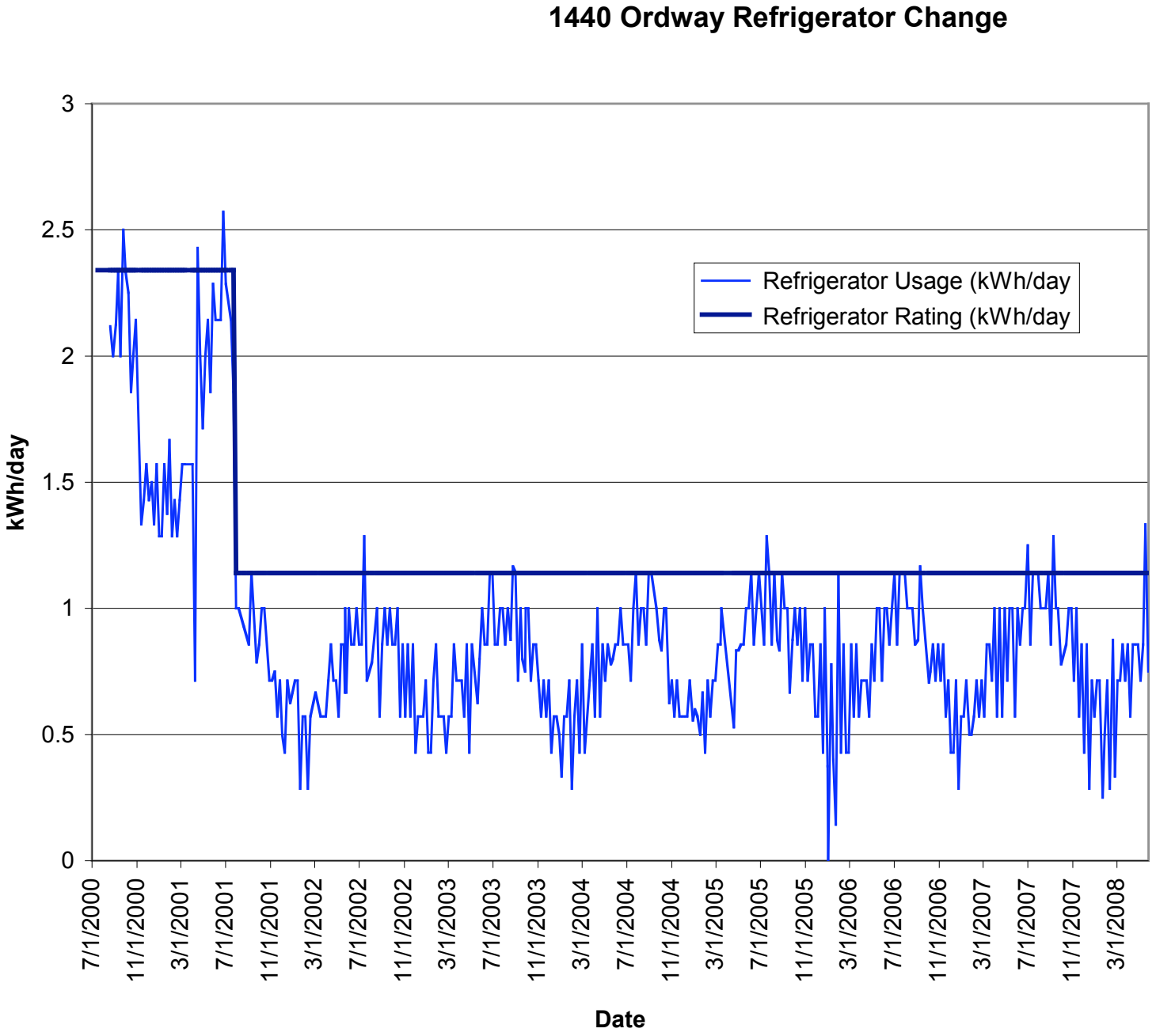
- Benjamin Franklin

Home Energy Retrofits

- Insulate walls, ceilings, floors, and water heaters
- Do a blower door test + seal air leaks
- Install high performance shower heads
- Scrap and replace an old refrigerator (see PG&E)
- If replacing windows anyway, buy double paned windows with low-E coating and argon gas fill.
- Lots of others—do or get an audit

U.S. Refrigerator Energy Use v. Time with Real Price




1440 Ordway Refrigerator Change
3
2.5
2
1.5
1
0.5
0
kWh/day
Refrigerator Usage (kWh/day
Refrigerator Rating (kWh/day
7/1/2000
11/1/2000
3/1/2001
7/1/2001
11/1/2001
3/1/2002
7/1/2002
11/1/2002
3/1/2003
7/1/2003
11/1/2003
3/1/2004
7/1/2004
11/1/2004
3/1/2005
7/1/2005
11/1/2005
3/1/2006
7/1/2006
11/1/2006
3/1/2007
7/1/2007
11/1/2007
3/1/2008
Date

Behavior is very effective and free

Control Home Energy Use

- No-cost
  - Turn it off/unplug it when not in use (be a vampire slayer)
  - Thermostat management
  - Shut off pilot lights in summer
- Low-cost
  - Buy (and properly use!) a programmable thermostat
  - Put motion sensors on lights
  - Power strips/plug in switches

Transportation Options

- Telecommuting
- Live near work
- Car pooling
- Trip merging
- Mass transit
- Bicycling
- Walking (we have feet…)

Driving: no-cost techniques to save lives, $, the planet

- **Drive slower!**
- Enhance aerodynamics:
  - Keep windows rolled up when driving at speed.
  - Remove roof racks when empty
- Accelerate slo-o-owly.
- Maintain constant speed - decelerate & accelerate gently, and only when required.
  - Choose a speed slightly below the flow of traffic (right lane!) so fewer speed changes are required.
  - Predict traffic changes far ahead.
  - Use cruise control if you find your speed creeping up every time you look at the speedometer
- The accessory that uses the most engine power is the AC system. Use it only when needed
  - Better to use than open window at speed.
- Use mpg gauge to play the "I can use less energy than *THAT*!" game.

  http://www.scangauge.com/
- Fresh Wax job. (optional)
- Proper tire inflation, low rolling resistance tires
- Check out http://www.ecodrivingusa.com/
- **Drive slower!**

Honda Civic VX
(with trashed aerodymamics)

47 mpg EPA rating, 43 mpg real average (but NOT as shown!)

Bicycles are not just for recreation and sport!

Bicycles are for transportation

- OSPP2 all hauled with bike trailer (http://www.bikesatwork.com)
- LBNL Bicycle Coalition:
  http://eetd.lbl.gov/bikes/

Transportation Resources

- Safe Routes to School and Transit:
  - http://www.saferoutesinfo.org/
- Bicycle Friendly Communities:
  - http://www.bikeleague.org/programs/communities/
- Local/regional (TripPlanner, RideSharing, etc):
  - http://www.511.org/
  - http://www.nuride.com
- TransLink:
  - http://www.translink.org/
- Spare the Air:
  - http://www.sparetheair.org/

Energy Information

- Home energy saver (DIY audit):
  - http://hes.lbl.gov/
- PG&E (rebates, info resources):
  - http://www.pge.com/myhome/
- Energy Star (appliances, equipment, homes):
  - http://www.energystar.gov/
- *Home Energy* magazine:
  - https://www.homeenergy.org/
- Solar California (rebates, tax credits):
  - http://www.gosolarcalifornia.ca.gov/

Bay Area Home Efficiency Services

- Advanced Home Energy (www.advancedhomeenergy.com)
- Applied Home Performance (www.appliedhomeperformance.com)
- Building Solutions (www.buildingsolutions.com)
- Sustainable Spaces (www.sustainablespaces.com)

More you can do

- Reduce your materials use
  - Recycle, precycle, and freecycle (http://www.freecycle.org/)
- Eat lower on the food chain
- Buy local
- Buy green power or offsets
- Travel less
- Check these out:
  - http://www.storyofstuff.com
  - http://www.fightglobalwarming.com/

Recycling, Hazardous Waste, and Water Information

Stop Junk Mail: http://www.stopjunkmail.org/

Water

East Bay Municipal Utility District:
http://www.ebmud.com/conserving_&_recycling/residential/

California Urban Water Conservation Council:
http://www.h2ouse.org/

Take-aways

- We owe the future to begin now
- Make commitment to act, and follow through
  - Baseline and track your impact
  - Plan and implement steps of progress
  - Iterate
- Boulding's First Law: Anything that exists is possible…
- Save the planet for fun and profit!

Q&A

- Questions FROM the audience
- Answers:
  - George Romney, 1958(?), introducing the American Motors Rambler

1962 Rambler American: 31 mpg winner

  - Richard M. Nixon, U.S. President, November 7, 1973, launching Project Independence after the first OPEC oil embargo